Social Capital, Inequality, and Economic Growth

by

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This paper analyzes a heterogeneous-agents OLG model incorporating both endogenous growth and social capital. An individual can either become an active part of the society's networks of trust and mutual co-operation, thus making a positive contribution to overall social capital. Alternatively, the individual can stay socially disintegrated and free-ride on the community's social capital. In the modelled economy, aggregate output, as well as economy-wide human capital and consumption, all grow at the average rate of individual human capital accumulation. An increase in inequality depresses the community's social capital, which, in turn, lowers the economy's growth rate. (JEL: D3, O41, Z13)

1 Introduction

One of the most commonly held prejudices among economists is that of an inherent and unavoidable trade-off between distributional equity and the supply of goods: You cannot divide the economic pie more equally and, at the same time, have more of it. This view appears to be theoretically well founded: In savings-driven growth models, such as the ones implicit in classical economists' writings, a more egalitarian income distribution involves a trade-off in terms of slower economic growth acting through a decline in national capital accumulation.[1] In neoclassical growth models of the Solow-Swan or optimal-capital-accumulation type, income distribution does not directly affect economic growth (see STIGLITZ [1969]). However, feasible policy instruments of redistribution are seen as distortionary and detrimental to savings and growth; or as a famous quote of OKUN [1975, p. 91] puts it: "the money must be carried from the rich to the poor in a leaky bucket. Some of it will simply disappear in transit".

In spite of being apparently well founded in economic theory, this conventional wisdom has been fundamentally challenged by a – large and still increasing – number of recent empirical studies (surveyed e.g. by BÉNABOU [1996]). These, all in all, deliver a consistent message: (initial) inequality is detrimental to long-run economic growth. Stimulated by both the empirical evidence and the emergence of endogenous growth theory, the last decade has witnessed a resurgence of academic work on income distribution and economic growth. This literature has worked out three basic sets of transmission channels through which inequality in income and/or wealth distribution might actually *slow down* economic growth. First, there are *economic* channels. For example in AGHION AND BOLTON [1997], capital market imperfections deny the poor to the efficient amount of investment; with decreasing returns at the individual level, redistribution to the less endowed will be growth enhancing since the latter's marginal product is higher.[2] A second economic channel stems from the fact that inequality affects an economy's demand structure and may therefore influence innovation incentives (see ZWEIMÜLLER [2000] or MATSUYAMA [2000]) and economic development (see MURPHY ET.AL. [1989]). In addition, there are *politico-economic* channels. In models

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[1] The long and distinguished stream of contributions viewing factor ownership as an essential determinant of individual savings behaviour spans physiocratic tableaus, Ricardian and Marxian theory, as well as post-Keynesian growth models. See ASIMAKOPOULOS [1988] for an extensive review of this literature. BERTOLA [1993] studies the role of factor shares and savings in an endogenous-growth setting.

endogenizing both economic growth and public policy, income inequality influences the balance of power in the political system in such a way as to generate pressure to government to increase income redistribution that, in turn, reduces incentives and, thereby, slows down economic growth.[3] This paper aims at highlighting a third set of channels linking inequality and growth that has received much less attention in the literature: *socio-economic* transmission mechanisms. Notable contributions to this field of study include ALESINA AND PEROTTI [1996], BENHABIB AND RUSTICHINI [1996] as well as KNELL [1999]. According to the former two, inequality may lead to socio-political instability and may thus have a detrimental effect on economic growth. KNELL [1999] considers the growth effects of inequality and status-seeking in a social comparison model with different degrees of status preferences for young and old individuals. The basic result is that the negative impact of inequality on growth is aggravated if individuals are more status-oriented.

The socio-economic transmission channel proposed in the present paper is based on the general idea that resources embedded in social networks of mutual trust and co-operation reduce transaction costs and are, thus, an important determinant of long-run economic success and growth. The concept of *social capital* provides a useful umbrella term to capture this intuition and growing awareness among some economists that 'society matters'.[4] There is no single definition of social capital, but rather various approaches to the concept exist. For the purpose of this paper, I choose an approach which is most closely related to COLEMAN's [1988], [1990] original concept and which tries to formalize social capital in a way to be broadly consistent with the following *five stylized facts*:

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[2] Further important papers within this subset of theory include GALOR AND ZEIRA [1993], BANERJEE AND NEWMAN [1993], and BÉNABOU [1996].

[3] Important contributions to this field of study include BERTOLA [1993], ALESINA AND RODRIK [1994] as well as PERSSON AND TABELLINI [1994]. PEROTTI [1993], as well as SAINT-PAUL AND VERDIER [1993], combine asset market incompleteness with the politics of redistribution.

(i) Social capital is mainly a public good in that it is shared by a group or society. COLEMAN [1988], [1990], defining social capital as consisting of socio-structural features or resources that are useful to individuals for specific actions, stresses social capital as a public good. These collective assets and features are available to all members of the community, regardless of which members actually promote, sustain, or contribute to such resources.

(ii) Social capital is produced by individual investment of time and effort, but in a less direct way than is human or physical capital. Without doubt, social capital is built, at least in parts, as a by-product of various social activities not necessarily undertaken with a view to strengthen social capital. PUTNAM [1993] gives the example that "members of Florentine choral societies participate because they like to sing, not because their participation strengthens the Tuscan social fabric".

(iii) Human capital investment also helps to develop social capital. COLEMAN [1988] stresses social capital's complementarity with human capital. Schools and other institutions of higher education can foster both values for social co-operation and social networks crossing different sectors of modern, functionally differentiated society. KNACK AND KEEFER [1997] report a strong correlation between trust and average schooling-years and mark – with reference to MUELLER [1989, pp. 364-365] – that "education may strengthen trust and civic norms, for example, if ignorance breeds distrust, or if learning reduces uncertainty about the behaviours of others, or if students are taught to behave cooperatively" [p. 1270].

(iv) Part of the instrumental value of social capital lies in the fact that most forms of education and training (human capital accumulation) are assisted by various types of community-based networks. It is again COLEMAN [1988], [1990] who emphasizes that social capital plays an important role in the process of building human capital. COLEMAN [1990, pp.

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[4] For instance, GRADSTEIN AND JUSTMAN [2000] present a political economy framework in which public schooling contributes to economic growth not only by building human capital but also by instilling common

590-97] offers three bits of evidence to show that children living within closed networks of adults are less likely to drop out of high school. PUTNAM [2000] reviews a large number of empirical studies which, among other things, report a positive link between social capital (civic engagement and trust) on the one hand and levels of education on the other hand.

(v) Growing inequality of income and wealth leads to a decline in social capital. PUTNAM [2000, p. 360] claims that the recent decline in US social capital, as measured by a composite index containing 14 indicators of formal and informal community networks and social trust, is linked to growing inequality of income and wealth. KNACK [1999] also finds trust and income equality to be positively correlated at the cross-country level. Finally, using US state-level data from the US General Social Survey, KAWACHI ET. AL. [1997] also argue that income inequality lowers social capital.

To illustrate the interactive growth effects of social capital and inequality, this paper adds to the existing literature in two significant ways. The first one is of mainly expository nature. It modifies the heterogeneous-agents overlapping-generations model first used by PERSSON AND TABELLINI [1994] and, subsequently, popularized by BÉNABOU [1996], as well as AGHION AND HOWITT [1998], by making explicit both the individual household's human capital accumulation and the economy's firms and production sector. Second and more importantly, it supplements the model's economic sector by an endogenous, rational-choice derivation of social integration and social capital formation. An individual can either become an integral part of the society's networks of trust and mutual co-operation, thus making a positive contribution to overall social capital. Alternatively, the individual can stay socially disintegrated, participate in the society's economic transactions but not contribute to the community's social capital, thus free-riding on others' investments in socio-structural

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norms that increase social cohesion.

resources. Within this formal framework, the present paper shows that, when the gap between the rich and the poor widens, the share of social drop-outs in the population making no positive contribution to the value of resources embedded in the society's networks will increase. As a result, the economy's social capital will be depressed which, in turn, lowers individual learning productivity, and discourages investment in human capital, thereby impeding economic growth. An increase in inequality, thus, possesses negative growth effects.

The rest of the paper proceeds as follows. Section 2 develops the formal framework of analysis, starting with decentral optimizing decisions of individual agents and then moving to aggregate variables describing macroeconomic behaviour. Section 3 solves for the economy's equilibrium growth path, explores the effects of increased inequality on the economy's growth rate and discusses potential implications for an active role of public policy in promoting social capital and economic growth. Section 4 concludes by providing a summary of results.

2. The Model

This section presents an endogenous growth model with a rational-choice derivation of social capital. The modelled economy consists of a sector of heterogeneous overlapping-generations households and a sector of firms producing the single good. Economic agents interact on a goods market, a labour market and a frictionless credit market.

2.1 Firms and Goods Production

Production is carried out by firms. They operate with a constant-returns-to-scale production function which transforms human capital, i.e. effective labour, into the homogenous consumption good. For parsimony, I assume:[5]

$$Y_t = A_Y H_t , \tag{1}$$

where Y_t denotes output, A_Y the productivity parameter and H_t the number of efficiency units of labour (human capital) hired by the producers. Firms choose the optimal amount of effective labour employed so as to maximize the firm value, taking prices as given. This leads to an inverse demand function for effective labour according to which human capital is paid its marginal product which, in turn, implies wage rates to be constant over time:

$$\forall t; w_t = w = A_Y . \tag{2}$$

2.2 Households and Human Capital Accumulation

In every period $t = 0,1,2,\ldots$ there exist two generations of economic agents: an old generation, born in the previous period and a young generation, born in t. All individuals have a life-expectancy of two periods and their number is constant over time. Each generation consists of a continuum of heterogeneous agents, indexed by $i \in [0,1]$, who differ in their human capital endowment.

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5 As in DE GREGORIO AND KIM [2000], it is assumed that no physical capital exists. An introduction of physical capital into the model would significantly increase the analytical effort involved while not changing the main features and results of the model.

Preferences

The individuals' preferences are defined over their respective consumption vector and are represented by a Cobb-Douglas utility function. Accordingly, the utility of an individual *i* born at date *t* is given by

$$U_t^i = \ln c_{1t}^i + \beta \ln c_{2t+1}^i , \tag{3}$$

where c_{1t}^i and c_{2t+1}^i, respectively, denote the consumption of agent *i* in the first and second period of her life. The parameter β is a non-negative subjective discount factor.

Youth

Individuals differ in their initial endowments with human capital. Person *i* of generation *t* is born endowed with $h_{1t}^i = \varepsilon_t^i h_{1t}$ units of human capital, where ε_t^i is an identically and independently distributed random shock with mean normalized to one that measures individual *i*'s access to general knowledge, $h_{1t} \equiv E\left[h_{1t}^i\right]$. Young households divide their total disposable time, which is normalized to unity, between working and learning. By working, I mean time spent in the current production of goods, whereas learning refers to the time spent by young individuals to enhance their stock of knowledge, skills or health capital. Denoting with *v* work time and with *e* the amount of human capital allocated to learning, individual *i* born at *t* faces the constraint

$$e_t^i = (1 - v_t^i) h_{1t}^i .$$

All individuals are assumed to have access to the same technology of human capital accumulation.[6] This technology converts time investment when young into improved labour

[6] At this stage of the model's development, this assumption might seem to be not quite as innocuous as presented. In particular, for an individual's access to education it plays no role whether she invests in social capital. Note, however, that according to the above stylized fact (i), social capital is mainly a public good implying, among others, its nonexcludability. Due to this public-good aspect of social capital, socially

quality generating a higher flow of labour services when workers are old. Specifically, I assume that in t+1 the flow of efficiency units of labour from individual i of generation t is

$$h_{2t+1}^{i} = A_h \left(e_t^i\right)^{\alpha} S_t^{(1-\alpha)}, \tag{4}$$

where $0 < \alpha \leq 1$, A_h is a constant technological parameter and S_t denotes the economy's social capital. According to education technology (4), agent i can supplement her initial level of effective labour only through private human capital investment into her education. However, the higher the general level of social capital S_t, the more each individual agent can rely on and is assisted by community-based assets and features to acquire new skills and knowledge. The learning technology is meant to capture the idea, emphasized by COLEMAN [1988], [1990] and PUTNAM [2000], that intellectual development is powerfully shaped by social capital. A considerable body of research dating back at least fifty years has demonstrated that community involvement is crucial to the success of formal education. These studies have found that student learning is influenced not only by what happens in school and at home, but also by social networks, trust, and norms in the school and in the wider community (see PUTNAM [2000, pp. 296ff.] for a more extensive survey).

Additionally, I assume intergenerational spillovers (as in PERSSON AND TABELLINI [1994]) through which the average level of knowledge achieved by generation t-1 is embodied in the average human capital endowment of generation t:

$$h_{1t} = \int_0^1 h_{2t}^i di = h_{2t} .^7 \tag{5}$$

With the fraction of human capital she does not invest into her further training, the young household earns a labour income. In addition, she can make use of a frictionless credit market

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disintegrated individuals are still able to capture the instrumental benefits of economy-wide social capital in their private human capital accumulation – thus free-riding on others' investments in socio-structural resources.

[7] As shown by BÉNABOU [1996], this dynamic linkage between generations can equivalently be motivated by altruistic parents who devote some of their second-period resources to their children's education.

where agents in each generation borrow from and lend to each other at the endogenous interest rate r. Let the amount borrowed by individual i of generation t be denoted by b_t^i. Then, individual i's young-age consumption is restricted by the following budget constraint:

$$c_{1t}^i \leq w_t\left(h_{1t}^i - e_t^i\right) + b_t^i . \tag{6}$$

Old age

When old, a household i born in t inelastically supplies all of her efficiency units of labour to goods production and earns an income y_{2t+1}^i. In addition, she has to make principal and interest payments to her creditors or receives such payments from her debtors, respectively. She spends her resulting net-income household on consumption:

$$c_{2t+1}^i \leq y_{2t+1}^i - (1 + r_{t+1})b_t^i = h_{2t+1}^i w_{t+1} - (1 + r_{t+1})b_t^i \tag{7}$$

2.3 Individuals, Society and Social Capital Accumulation

In order to formalize the intuitive ideas and stylized facts presented in the introduction, I assume that in period t an economy's social capital, S_t, simply consists of the sum of resources, s_t^i, that each of its individual young members is willing to embed into the social structure:

$$S_t = \int_0^1 s_t^i di . \tag{8}$$

Due to the public-good characteristics of social capital, no individual has an incentive to directly invest time and/or effort in its accumulation. However, every young individual rationally decides whether she wants to become an integral part of the social community sharing a general social orientation (language, culture, ideology, etc.) or not. If an individual opts for social disintegration she does not actively promote or sustain social interactions and networks and, thus, does not contribute to the economy's social capital. If, instead, an individual chooses to become an active part of the society's networks of trust and co-operation, she makes a positive contribution to the value of resources embedded in these networks. With reference to the stylized facts, I model social capital formation as a by-product of learning, i.e. human capital accumulation. To fix ideas, I assume, furthermore, that the social capital produced by any socially integrated individual is simply proportional to the general level of her generation's human capital endowment. It follows that:

$$s_t^i = \begin{cases} 0, \text{ if } i \text{ is socially disintegrated} \\ \\ A_S h_{1t}, \text{ if } i \text{ is socially integrated.} \end{cases} \tag{9}$$

Every young individual bases her rational-choice decision on whether to socially integrate or dissociate herself on a comparison of advantages and disadvantages. On the one hand, being part of a community with shared beliefs, language, ideology, etc. will improve one's own happiness and well-being.[8] To keep the exposition tractable, I simply assume that social integration gives any individual member of society a "warm-glow" utility denoted by the strictly positive constant $u_S^+ > 0$.

On the other hand, however, social integration does not come without costs. For one to become an integral part of the community, one has to adapt oneself to the group's common attitudes and social orientation which, probably, will deviate from one's own. In terms of COLEMAN's [1990] rational-choice sociology, by joining a social community an individual gives up the rights to control certain of her own actions and transfers these rights to the collectivity. This transfer of rights imposes costs on the individual which are indicated by the difference in utility levels actually secured, and that which would have been secured under

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[8] With reference to empirical studies on the association between supportive relationships and self-reported happiness and well-being, PUTNAM [2000, p. 332] sums up that "in study after study, people themselves report that good relationships with family members, friends, or romantic partners – far more than money or fame – are prerequisites for their happiness".

full maintenance of individual rights to control one's own actions. As outlined in COLEMAN [1990, 234f.], these costs will be all the higher, the less the individual's preferred behaviour is congruent with the community's prevalent norms or expectations. Since in the model individuals differ only with respect to their initial human capital, it is natural to assume that individual social orientation is (perfectly) correlated with individual young-age human capital endowment. Accordingly, I measure the cultural distance between young individual *i* and the community's social orientation by $\left|h_{1t}^{S} - h_{1t}^{i}\right|$, where h_{1t}^{S} denotes the community members' average human capital endowment. Furthermore, COLEMAN's [1990] reasoning implies that the larger this distance, the higher is individual *i*'s disutility from social integration, as indicated by

$$d_S^i = d_S^i\left(h_{1t}^S, h_{1t}^i\right), \qquad \frac{\partial d_S^i}{\partial\left|h_{1t}^S - h_{1t}^i\right|} \geq 0 .$$[9]

An alternative theoretical motivation for the proposed utility loss caused by investments into social capital comes from the social comparison literature: Economic agents derive (dis-) utility from social comparisons they perform – an idea that can be traced back to the writings of Marx, Durkheim and Veblen (see FALK AND KNELL [2000]). In more recent times, both a growing theoretical literature in economics and empirical studies on happiness and subjective well-being advocate the fact that individual perceptions of well-being crucially depend on performance *relative* to a reference group rather than on absolute income or consumption (see CLARK AND OSWALD [1996]). FALK AND KNELL [2000] stress the fact that individuals have at least some discretion about their reference standard, i.e. they can at least partly choose their reference groups. Applying this reasoning to the present model, social integration and compliance with the society's norms may be viewed as choosing the community's average wealth level as one's individual comparison standard.[10] Obviously, with this reference standard, for any "less-than-average" individual social integration comes at a loss of individual well-being and this ceteris-paribus disutility will be the higher, the poorer endowed that individual is.

To fix ideas, I will restrict my attention to the following specified form of the above disutility function:

$$d_S^i\left(h_{1t}^S, h_{1t}^i\right) = d_S^i\left[\frac{h_{1t}^S}{h_{1t}^i}\right] = \begin{cases} 0, & \text{for } h_{1t}^i \geq h_{1t}^S \\ a\left(\frac{h_{1t}^S}{h_{1t}^i} - 1\right), & \text{for } h_{1t}^i < h_{1t}^S. \end{cases} \tag{10}$$

The following reasoning might give rise to function (10): The prevalent social norms expect a society's young members to have at least the average amount of skills and knowledge. Therefore, anyone with human capital endowment at least equal to h_{1t}^S will be able to comply with this social norm without any loss of individual well-being.[11] On the other hand, any young individual with less than h_{1t}^S will still be allowed to join the community, but will suffer from his noncompliance with the social norms. E.g., from time to time, she will be laughed or jeered at: maybe because her mastery of the common language is less than perfect; or because she reveals her ignorance of matters and affairs that are general culture or common

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9 A similar disutility function can be found in GRADSTEIN AND JUSTMAN [2000] refering to the cultural distance between parents and child in an ethnically divided society with public schooling.

10 KNELL [1999] classifies this normative reference point as "society-wide comparisons" and uses it, as well as two alternatives types of reference group specification to be found in the literature on this subject, in his study on social comparisons, inequality and growth.

11 In other words, the social norm considered takes the form of a *minimum* requirement. Accordingly, individuals above average do not incur any costs of integration. The specific disutility function (10) facilitates the formal analysis, but is not crucial for the results obtained. As a matter of fact, if one assumed – in accordance with the general disutility function given above (10) – that integration costs increase in distance from the average and regardless of the direction of deviation, a mean-preserving spread in h^i would raise the costs of social integration for individuals at *both* tails of the income distribution. Thus, the negative impact of inequality on economic growth would be even stronger than with the specification given in (10).

knowledge; etc. Therefore, her adherence to the community's social orientation comes at a loss of individual well-being.

While still enjoying the warm-glow effect of being a part of a community, poorly endowed individuals, thus, have to weigh u_S^+ against the disutility d_S^i caused by their social integration. For any individual *i*, overall net utility from social integration will be given by

$$u_S^i = u_S^+ - d_S^i, \tag{11}$$

and agent *i* chooses social integration as long as her net utility is positive. Given our simple functional specifications, all those members of generation *t* will socially integrate for whom

$$h_{1t}^i > \frac{a}{u_S^+ + a} h_{1t}^S =: h_{1t}^j. \tag{12}$$

All individuals with human capital endowment above h_{1t}^j actively engage in social interactions and networking, thus making a positive contribution to the economy's social capital. On the other hand, individuals with abilities below h_{1t}^j opt for social dissociation. They participate in the society's economic transactions, but they do not contribute to the community's social capital. Due to the public-goods aspects of social capital, they are, nevertheless, able to capture the instrumental benefits of economy-wide social capital in their private human capital accumulation, thus free-riding on others' investments in socio-structural resources.

In addition, equation (12) implies that the fraction *j* of generation *t* which is socially disintegrated comes from the poorest endowed members of this generation. This result is in accordance with the sociological literature on the structure and dynamics of social isolation which contends that individual dissociation from society is inextricably linked to poverty (see WILSON [1987, 1991]).

Taking into account that the continuum of individuals in every generation is defined over the intervall [0,1], the fraction j of generation t which is socially disintegrated is given by the value of the cumulative distribution function of the variable h_{1t}^{i}, denoted by $F_h(\cdot)$, at h_{1t}^{j}:

$$j = F_h\left(h_{1t}^{j}\right). \tag{13}$$

Moreover, the distribution of relative endowments, $h_{1t}^{i}/h_{1t} = \varepsilon_t^{i}$, is stationary which results in a time-invariant share of social drop-outs in the population.

For parsimony, I will focus on the case that $\ln h_{1t}^{i}$ is normally distributed with mean μ_t and variance σ_t^2, i.e. $\ln h_{1t}^{i} \sim \mathcal{N}(\mu,\sigma^2)$. Then j is implicitly defined by the value of the cumulative *standard* normal distribution function at

$$\frac{\ln h_{1t}^{j} - \mu}{\sigma} = \sigma^{-1}\left\{\ln\frac{a}{u_S^{+} + a} + \ln h_{1t}^{S} - \mu\right\} =: x\,,$$

i.e.

$$j - \Phi(x) = 0. \tag{14}$$

This expression can be utilized for an analysis of the effects which an increase in income inequality has on a generation's rate of social integration:

LEMMA 1: Assuming human capital endowments to be log-normally distributed, a more unequal distribution, in the sense of a mean-preserving spread in h^i, leads to an increase in the share j of the population that is not socially integrated and, thus, does not contribute to the economy's social capital.

Proof: See appendix *Q.E.D.*

A simple formula for the economy's aggregate social capital can now be derived. With (13), it follows from (8) and (9) that

$$S_t = \int_0^1 s_t^i di = \int_j^1 A_S h_{1t} di = (1-j)A_S h_{1t}\,. \tag{15}$$

With LEMMA 1 in mind, (15) implies an inverse relationship between inequality and social capital: A more unequal distribution leads to an increase in the share j of individuals in a generation who make no positive contribution to the value of resources embedded in the society's networks and, thus, to a reduction in the economy's social capital. Furthermore, given (15), the individual technology for human capital accumulation can be expressed as

$$h_{2t+1}^{i} = (1-j)^{1-\alpha} A_H \left(e_t^i\right)^{\alpha} h_{1t}^{\;1-\alpha}, \tag{16}$$

where for notational convenience I have defined:

$$A_H := A_S^{\;1-\alpha} A_h \,.$$

According to (16), individual returns on human capital investments are decreasing, but the aggregate learning technology is linear due to *intra*generational knowledge spillovers that reflect the productive role of social capital.

2.4 Individual Optimization

Since training provides no non-pecuniary benefits, the Fisher separation theorem implies that individuals' educational choices are made to maximize wealth. Thus, the individual problem of lifetime-utility maximization can be solved as a two-step procedure. As the first step, household *i* of generation *t* chooses her optimal amount of human capital invested in further education, e_t^i, to maximize her discounted lifetime income:

$$\underset{e_t^i}{\text{Max}} \quad y_{L_t}^i = w_t\left(h_{1t}^i - e_t^i\right) + \frac{h_{2t+1}^i w_{t+1}}{1+r_{t+1}}$$

$$\text{s.t.} \qquad 0 \le e_t^i \le h_{1t}^i\,,$$

$$h_{2t+1}^i = (1-j)^{1-\alpha} A_H \left(e_t^i\right)^{\alpha} h_{1t}^{\;(1-\alpha)}\,. \tag{P1}$$

From first-order conditions, it follows that

$$\alpha \frac{h_{2t+1}^i}{e_t^i}\frac{w_{t+1}}{w_t} = 1 + r_{t+1}\,. \tag{17}$$

The return to an additional unit of human capital consists of its marginal product plus the gains that are connected with a change in the wage rate. Thus, condition (17), that governs optimal allocation of time, rules out any arbitrage between the returns to a human capital investment (left-hand side) and the returns to lending – or costs of borrowing, respectively – in the credit market (right-hand side). Furthermore, (17) implies that every individual invests the same amount of effective labour, e_t; hence, it follows that

$$\forall i; \quad y_{2t+1}^i = (1-j)^{1-\alpha} A_H e_t^{\alpha} h_{1t}^{(1-\alpha)} w_{t+1} =: y_{2t+1} . \tag{18}$$

As the second step of her lifetime-utility maximization problem, the household intertemporally allocates her consumption by choosing her young-age net borrowing (or lending), b_t^i, while taking as given her optimal time allocation (17). Regardless of their human capital endowments, all agents choose the slope of the consumption path according to the usual Euler equation. Given the logarithmic utility function (3), this implies

$$\frac{c_{2t+1}^i}{c_{1t}^i} = \beta(1+r_{t+1}) . \tag{19}$$

Utilizing individual budget constraints (6) and (7), as well as the no-arbitrage condition (17), (19) becomes

$$\frac{c_{2t+1}^i}{c_{1t}^i} = \frac{(1-j)^{1-\alpha} A_H e_t^{\alpha} h_{1t}^{(1-\alpha)} w_{t+1} - (1+r_{t+1}) b_t^i}{\left(h_{1t}^i - e_t\right) w_t + b_t^i} = \beta\alpha A_H (1-j)^{1-\alpha} \frac{w_{t+1}}{w_t} \left(\frac{h_{1t}}{e_t}\right)^{(1-\alpha)} .$$

Summing over all agents and making use of the loan-market clearing condition,

$$\int_0^1 b_t^i di = 0 ,$$

finally yields

$$e_t = \frac{\beta\alpha}{1+\beta\alpha} h_{1t} =: u h_{1t} . \tag{20}$$

According to (20), each household invests the same fraction u of her generation's *average* human capital endowment into her further education.

3.1 Growth Effects of Inequality

The average growth rate of individual human capital within each generation is given by

$$\gamma_t^h := \frac{\int_0^1 h_{2t+1}^i di}{\int_0^1 h_{1t}^i di} = \frac{((1-j)A_S)^{1-\alpha} A_h (uh_{1t})^\alpha h_{1t}^{(1-\alpha)}}{h_{1t}} = (1-j)^{1-\alpha} A_H u^\alpha . \qquad (21)$$

For the labour market to clear in any given period, the input of efficiency units of labour into goods production must equal the sum of the young and old generations' effective labour supply:

$$H_t = \int_0^1 h_{2t}^i di + \int_0^1 (h_{1t}^i - e_t^i) di = (2-u) h_{1t} .$$

Thus, it can readily been seen that the average individual and the aggregate growth rates of human capital coincide:

$$\gamma_t^H := \frac{H_{t+1}}{H_t} = \frac{h_{1t+1}}{h_{1t}} = \gamma_t^h .$$

Since human capital is the ultimate driving-force of the economy, its common rate of accumulation also determines the growth rates of the model's other level variables:

PROPOSITION 1 (Long-term growth): In the modelled economy, aggregate output, as well as economy-wide human capital and consumption, all grow at the average rate of individual human capital accumulation:

$$\gamma^* = \gamma^Y = \gamma^C = \gamma^H = \gamma^h = (1-j)^{1-\alpha} A_H u^\alpha .$$

Proof: It has already been shown that $\gamma_t^H = \gamma_t^h$. From (1), it immediately follows that

$$\gamma_t^Y := \frac{Y_{t+1}}{Y_t} = \frac{A_Y H_{t+1}}{A_Y H_t} = \gamma_t^H = \gamma_t^h .$$

Finally, the goods market clearing condition or resource constraint of the modelled economy without physical capital requires $C_t = Y_t$, where C_t is aggregate consumption. Therefore,

$$\gamma_t^C := \frac{C_{t+1}}{C_t} = \frac{Y_{t+1}}{Y_t} = \gamma_t^Y = \gamma_t^H = \gamma_t^h . \qquad \textit{Q.E.D.}$$

As shown by LEMMA 1, the share of socially disintegrated individuals in a generation depends on the extent of the economy's inequality. Therefore, a mean-preserving spread in the distribution of human capital endowment influences the economy's growth rate by its adverse effects on social capital:

PROPOSITION 2 (Growth effects of inequality): An increase in inequality reduces the economy's growth rate.

Proof: As shown by LEMMA 1, a mean-preserving spread in the distribution of human capital endowment increases the share j of individuals in a generation who make no positive contribution to the economy's social capital, i.e. $\partial j / \partial \sigma^2 > 0$. Furthermore,

$$\frac{\partial \gamma^*}{\partial j} = -\frac{(1-\alpha) A_H u^\alpha}{(1-j)^\alpha} < 0 .$$

Thus,
$$\frac{\partial \gamma^*}{\partial \sigma^2} = \frac{\partial \gamma^*}{\partial j} \frac{\partial j}{\partial \sigma^2} < 0 . \qquad \textit{Q.E.D.}$$

The growth rates of both aggregate human capital and output are reduced by higher inequality for the following reason: A mean-preserving spread in the distribution of human capital endowments widens the cultural gap between the rich and the poor in a society. Accordingly, for a higher fraction of those poorly endowed the costs caused by compliance with the community's norms will outweigh the advantages of social integration. Therefore, the share of social drop-outs in the young generation, who will make no positive contribution to the value of resources embedded in the society's networks, will increase. As a result, the economy's social capital is depressed, which, in turn, lowers individual learning productivity, and discourages investment in human capital, thereby impeding economic growth.

3.2 Inequality, Social Capital and Public Policy

Given the public goods nature of social capital and due to the positive external effects of social integration, individual incentives to socially integrate are below the social optimum at all times. As was shown above, an increase in inequality further depresses the community's social capital, which has detrimental effects on economic growth. Both of these results might imply some active role for state leaders and public policy trying to exploit the growth and welfare potential which is created by too low a supply with, or a further reduction in, social capital.

First, with regard to counteracting a (further) reduction in social capital caused by (an increase in) inequality, one is naturally led to think of redistribution through a government tax-and-transfer scheme. However, individual costs of social integration stem from the individuals' heterogeneity in initial human capital endowments. Accordingly, for redistributive policies to potentially have any growth benefit, they must take place before investment in social capital, i.e. social integration, is completed. By what measures could the original endowments be changed and by whom? AGHION ET.AL. [1999] consider an ex-ante redistribution of endowments which consists of taxing highly endowed individuals directly on their endowments, and then using the revenues from this tax to subsidize the less endowed.[12] This amounts to a lump-sum tax-and-transfer policy and, therefore, only affects the incentives to invest in education insofar as it changes the economic agents' current wealth. In the above

[12] Supposing that human capital endowments are acquired – with different talents and under diverse social conditions – during an (unmodelled) first period of life with compulsary school attendance, such a policy corresponds, for instance, to a redistribution of education budgets across rich and poor school districts, as is done explicitly in a number of U.S. states and implicitly in countries with a national system of education financing. More detached from the above model's set-up one can, equivalently, think of a land reform as a means to redistribute original endowments. ALESINA AND RODRIK [1994], among others, refer to the idea that land reform was an important factor in the growth performance of Japan, Korea, and other Asian countries, in particular when compared to Latin American economies.

model, any household's investment in human capital accumulation is independent of individual current wealth. On the other hand, a more equal distribution of endowments increases social capital and, thus, makes human capital accumulation more productive. As a result, redistribution will have an overall positive effect on aggregate output and growth. In reality, of course, lump-sum taxation is rare (to say the least). If redistribution were financed through distortionary (ex-post) taxation, there would be a negative incentive effect which would conflict with the positive learning productivity effect of higher social capital: taxation reduces net returns to education investments and, therefore, individuals' incentives to build human capital. Then, whether redistribution raises or reduces the rate of growth depends on which of the two conflicting effects dominates.

Secondly, the general role of government in sustaining social capital is less clear than in the case of other factors that determine a nation's productivity, e.g. physical and human capital. Public policy may often have the role of facilitator, rather than main actor. Nevertheless, government and other public agencies have a diffuse, yet collectively powerful influence on social capital formation. One central organizational problem faced by public policymakers stems from the fact that agencies whose actions influence social capital are spread throughout government and the private sector, requiring skillful and innovative co-ordination by politicians and state leaders. Certainly, the above model can only be considered as a first step towards a more detailed analysis. In general, research on social capital is at an early stage of development. Therefore, it is not yet possible to say with any degree of confidence whether any given programme or policy will fail or succeed in realizing its social capital objectives. Our understanding of public policies for social capital can only be developed through policy development and evaluation. Some policy options that, at the present stage of knowledge, seem worthy of further development include among others: the provision of fiscal support, as well as legal arrangements, to facilitate more parental involvement in their children's lives; measures to encourage both the demand for and supply of voluntary community activity;

programmes to stimulate innovation through networking; and with regard to the government decision-making process, a strengthening of citizens' democratic empowerment and the proximity of government – in particular on the local and regional levels.

4. Conclusion

This paper has analyzed a model of overlapping generations with heterogeneous agents and endogenous growth incorporating both human and social capital accumulation. An individual can either become an active part of the society's networks of trust and mutual co-operation, thus making a positive contribution to overall social capital. Alternatively, the individual can socially dissociate herself, participate in the society's economic transactions but not contribute to the community's social capital. In the modelled economy, aggregate output, as well as economy-wide human capital and consumption, all grow at the average rate of individual human capital accumulation. An increase in inequality, as measured by a mean-preserving spread in the young-age human capital endowment, has been shown to depress the economy's social capital which, in turn, lowers individual learning productivity and discourages investment in human capital. As a result, a more unequal distribution is detrimental to the economy's growth rate.

All in all, the above analysis – while in itself fairly restrictive – serves to make a point of more general validity. The resources embedded in social networks of mutual trust and co-operation are an important determinant of long-run economic success and growth. Therefore, in addition to economic and politico-economic transmission channels mediating the relationship between distribution and growth, there obviously also exist *socio-economic* ones. As mentioned before, the specific transmission mechanism demonstrated in the present paper should be seen as merely one of several channels through which inequality and social background conditions interact to constrain or foster growth – channels remaining to be further elaborated on in future research.

Furthermore, the above remarks should only be considered as a first step to a more detailed analysis of the potential role for governments to influence the process of social capital formation and, thereby, foster economic growth. In general, research on policies for social capital is at an early stage of development. Thus, to develop our understanding of public policies for social capital both theoretically and through policy development and evaluation, is another promising area of further research.

Finally, the above model analyzed the effect of a more unequal distribution on long-term growth, but had nothing to say about the reverse effect. Since fast growing economies tend to show signs of a more unequal distribution of skills, this could act as a brake to high growth rates in the long run. Indeed, a one-time reduction in inequality fostering human capital building and economic growth in the short run might even result in an upsurge in inequality in the long run, thus calling for permanent redistribution policies in order to control both the level of inequality and to foster social capital and economic growth. A formal analysis of these mutual interactions seems to be a third promising line of enquiry for further research.

Appendix: Proof of Lemma 1

The society's normative point of reference is given by the community members' average human capital endowment, h_{1t}^S, which, under the assumption of log-normally distributed h^i, follows as

$$h_{1t}^S = \frac{1}{\sqrt{2\pi}\sigma} \int_j^1 \exp\left\{ -\frac{\left(\ln h_{1t}^i - \mu\right)^2}{2\sigma^2} \right\} di \, .$$

Since h_{1t}^S as an element of *x* depends on *j*, equation (14) only implicitly defines j. Let an increase in inequality be identical with or correlated to a mean-preserving spread in h^i, as indicated by an increase in σ^2. Utilizing the implicit function theorem, it follows that

$$\frac{\partial j}{\partial \sigma^2} = -\frac{-\left(\partial \Phi / \partial \sigma^2\right)}{1-\left(\partial \Phi / \partial j\right)},$$

with $$\frac{\partial \Phi}{\partial \sigma^2} = \left\{ \frac{1}{h_{1t}^S \sqrt{2\pi}} \int_j^1 \frac{\left(\ln h_{1t}^i - \mu\right)^2}{2\sigma^2} \exp\left\{ -\frac{\left(\ln h_{1t}^i - \mu\right)^2}{2\sigma^2} \right\} di + \frac{1}{2}\left\{ \ln\left[h_{1t} / h_{1t}^j \right] + \frac{\sigma^2}{2} \right\} \right\} \frac{1}{\sigma^3} \frac{\partial \Phi}{\partial x} > 0$$

and $$\frac{\partial \Phi}{\partial j} = -\frac{\partial \Phi}{\partial x} \frac{1}{\sigma h_{1t}^S} \exp\left\{ -\frac{(\ln h_{1t}^j - \mu)^2}{2\sigma^2} \right\} < 0 .$$

Thus, $$\frac{\partial j}{\partial \sigma^2} > 0 .$$

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